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THE COLORADO DESERT AND ITS RECENT FLOODING.

BY

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This article will give :

- I. A BRIEF DESCRIPTION OF THE COLORADO DESERT.
- II. AN ACCOUNT OF ITS RECENT FLOODING.
- III. THE PROBABLE RESULTS.

I.

The Colorado desert lies between the 32° and 34° parallels of north latitude, and 38° and 40° longitude West from Washington.* Its larger portion is in the extreme south-eastern end of California, in San Diego County, and a smaller portion is in the north-eastern end of Lower California.

Its general shape is that of a triangle, with the apex to the north-west. The Sierra Madre, with an average altitude of 6,000 feet above the sea-level, forms its western side. Its eastern side is a spur of the Sierra Madre, which runs south-easterly about 180 miles to the Colorado River, at an average altitude of 4,000 feet. The desert valley opens south-easterly towards the Gulf of California. Its total area is nearly 6,000 square miles, of which 3,900 square miles is below sea-level, ranging from various depths to 360 feet, but averaging from 150 to 250 feet.

* 115° and 117° W. from Greenwich, as on the map.

The surface, excepting this great depression, has a general slope towards the Gulf.

Fifteen miles west of the town of Yuma, at the junction of the Gila (pronounced *Hee'-lah*) and Colorado rivers, are the Cargo Muchacho buttes, which cover about 36 square miles.

In the Mexican portion of the desert are the Co-co'-pah mountains, which run only about 90 miles in a north-westerly and south-easterly direction, and have an average altitude of 2,000 feet. At the western base of these mountains is Lake Maquata (pronounced, *Mah-quah'-tah*), which is about 40 miles long, and 8 miles wide. Its waters are very salty.

The soil of the desert is composed mostly of sand and gravel, covered in many places with vast deposits of different salts, and in some localities with large bodies of common salt.

Scattered here and there are many beds of hot, wet mud, which heave and fall with escaping sulphurous gases, and which are popularly called "volcanoes." Near the Cocopah mountains is an extensive region of these volcanoes of greater or lesser size, with accompanying mineral springs.

The only streams which run in to the desert, except New River, are the White Water, San Felipe and Cariso, on the west side. The two last-named have water only for a short time during the rainy season. What little water they ever do carry is rapidly absorbed by the desert sands.

Owing to the extreme lack of moisture and the excessive heat during a greater part of the year, only the hardiest members of the vegetable kingdom are able

to grow, and that in the most favorable localities. The principal tree is the mesquite (pronounced, *mess-keet'*, the *Prosopis Juliflora*). The Indians subsist chiefly on its beans. There are many varieties of cactus, including the saguaro (*C. Giganteus*). Grasses flourish only for a brief period on the overflowed lands after the floods. In some localities the forests of mesquite are quite extensive, and in many places along the northern edge of the desert are groves of the fan palm (*W. Filifera*), which bears a very sweet fruit.

The Indians, who inhabit this region, number about 400, and belong to the Cahuilla (pronounced, *Kah-weel'-yah*) tribe; they are a long-lived race.

The fauna is restricted to the coyote (*Canis Latrans*), the scavenger of the ground, and the vulture (*Cathartes Aura*), the scavenger of the air; and in the limited mesquite forests are many varieties of birds of bright-hued plumage or sweet voices; besides rabbits, reptiles, etc.

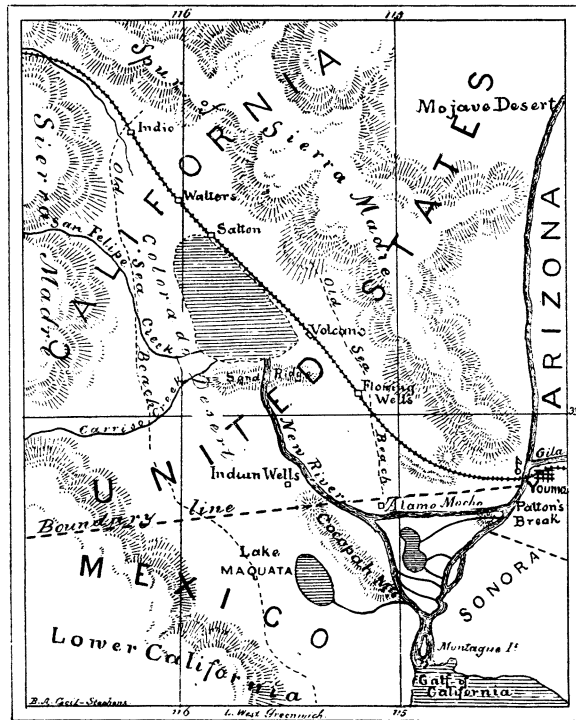
The average annual precipitation is about two inches, evaporated almost as quickly as it falls. The heat from February till November ranges from 110° to 130° F.

A vast, verdureless and waterless plain, with high and barren mountains on either hand, a burning sun fiercely glaring upon hot, white sands occasionally stirred by an atmosphere like a furnace-blast, briefly paints a picture of the Colorado desert.

The first white man to cross the Colorado desert was Captain Juan Bautista de Anza, who, under royal orders from Spain, in the year 1774, went from Yuma to San Felipe pass, in exploring an overland route from Sonora to California. The San Gorgonio pass, through

which White Water River flows, was subsequently more travelled. This was the way of the Argonauts of 1849-50, of whom some 60,000 came by the southern route, many of whom were lured to death by the mirage, common to all deserts.

In 1877, the Southern Pacific Railroad was built from San Gorgonio pass, skirting the eastern edge of the desert, to Yuma. Its surveyors determined the different points of the road below sea-level as follow, in feet: Indio, 20; Walters, 195; Salton, 263; Volcano, 225; Flowing Wells, 5; a distance of 59 miles.



Mr. Cecil-Stephens assumes all responsibility for his map.

This great depression has always excited more curiosity and interest than any of the many other wonders of the desert. It is about 130 miles long with an average width of 30 miles. Its entire rim is sharply defined by water-worn rocks and old sea-shells; in fact, it is the beach of an ancient sea. When and how was this old lake dried up? A slight examination of the geography next to the Gulf easily answers these questions.

Touching the desert on its eastern side, and from 100 to 400 feet above it, is the Colorado River on its 1,400-mile course from the Rocky Mountains to the Gulf of California. Its waters are colored red by the immense amount of sediment which they carry; hence the name. All the land between Yuma and the Gulf, a distance of 160 miles, has been made by the river, whose banks are higher than the country on either side.

There is an old Spanish map, which marks the Gila River as emptying directly into the Gulf; and, while this was once undoubtedly true, it was long prior to the time of that map-maker. The Gulf then extended some 200 miles north of its present limits to the neighborhood of Indio. The river floods, assisted by the Gulf tides, formed the bar which divides the Gulf from the old desert sea-bed. This bar is only about 15 miles wide, and surveys show that a channel could be easily cut through it.

As the waters of the desert sea evaporated, they became heavier from their salty parts, and gradually retreated towards the lowest portion of the bed, where the greater quantity of their salt was deposited. This accounts for the large mine at Salton, which is worked for commercial purposes.

In 1859, Dr. O. M. Wozencraft obtained a conditional cession from Congress to run an irrigating canal from the river near Yuma westerly on the desert for reclaiming some 1,600 square miles of arable land. Surveys demonstrated the practicability of the scheme, but the Doctor's death stopped the work.

II.

The Colorado River seems to have repented of its evil work, and is now seeking to atone for its great sin, in desolating so large a portion of the earth, by refilling the desert sea.

From 15 to 40 miles above the Gulf there are many breaks in the west bank of the river, from 20 to 50 feet above sea-level, through which the water flows in the flood seasons. The channels from these breaks unite in one, called New River, which runs back down into the desert over 100 miles to the Indian Wells region, 38 feet below sea-level. One branch of New River feeds Lake Maquata.

Twice a year, in February and June, the Colorado River is full; first from the heavy winter rains in the Rocky Mountains and again from the melting snows in summer. Since 1871, twenty years, New River has extended its channel northward fully twenty miles. In this work it has been assisted by the great tidal wave or *bore* of the Gulf, which has been marked at Montague Island, at the mouth of the river, as high as 32 feet. This *bore* comes in with the spring tides, and rushes far up the Colorado and New River. It is very dangerous to navigation, but it announces its approach with a roar that is heard for miles.

Hitherto, the floods of New River have not reached as far north as Salton because of a sand ridge formed by the winds across it, about ten miles long, a half a mile wide and nine feet high.

The winter of 1890-91 was one of the wettest ever recorded on the Pacific coast. Heavy rains fell for a long time, and all the streams were running bank-full and overflowing for a greater period than usual. The Colorado River reached the highest point ever known, since observations were first taken in 1850, being marked at Yuma at 33 feet and 6 inches, in February, 1891. This last high water caused New River to boom as never before, but the results were not apparent till the following June.

On the 23d of that month the people at Salton first noticed small streams of water trickling down into the marsh. Day by day the water has increased in volume until now a lake forty miles long and ten miles wide, with an average depth of four feet, is visible to the west and south. The daily average rise has been and continues at the rate of about one inch.

The discovery created a sensation which the press speedily published far and wide.

About two weeks later, two prospectors returned to San Diego City, and reported that the Indian Wells region, containing about 3,200 square miles, was flooded by New River. Later, a Mexican rode up from Lower California on horseback, along the eastern side of the Sierra Madre, till he found a place shallow enough to ford, when he crossed to the railroad, and confirmed the report of the flooding of the Indian Wells country.

The water continuing to rise at Salton, and no satis-

factory account of its cause being known, Mr. H. W. Patton, of the *Banning Herald*, being outfitted by the *San Francisco Examiner*, left Yuma on July 9th in a small boat, accompanied by guides, and sailed down the Colorado River about forty miles, where, at a point about 340 feet above the lowest part of the desert, he found a break in the west bank about a mile wide through which the water is flowing down into the desert.

Here, a bar is forming, which it seems will eventually turn the whole volume of the river into the desert. Turning into the main channel, which is about 200 yards wide and 18 feet deep, with a current of 4 miles per hour, they floated along over the old overland stage route. Marks on the trees showed that the water had been 4 feet higher.

At Alamo Mocho, an old station 52 miles southwest from Yuma, there was water all over the country as far as they could see. Ten miles west of Alamo Mocho they met the New River stream, coming from the south, 100 feet wide and 12 feet deep. Here the two streams united, and turned to the north, 300 yards wide and 14 feet deep with a current of 6 miles per hour. At places the stream spreads out into large lakes.

On the 12th they passed through a large break in the sand ridge, which hitherto prevented the New River floods from entering the Salton basin. This break was 200 yards wide and 7 feet deep, and the current was very swift. After going through this break they saw 10 large streams join their channel on the west, showing that there are other breaks in that direction. Sailing through a chain of lakes on the 14th, they saw a large stream flowing in from Carriso Creek, and that even-

ing they safely landed at Salton, having made a voyage of over 200 miles, and demonstrated the source of the flood.

Last May the annual summer rise of the Colorado began. July 19th, the river marked 21 feet and 8 inches at Yuma. Low water mark is 12 feet, although it has not been below 14 feet and 6 inches for 13 years. This summer rise, aided by a bore in June, caused the waters of the Indian Wells basin, already filled by the February flood, to break through into the Salton basin, 225 feet lower. The desert area flooded to date is not less than 3,500 square miles.

III.

Will the flood be permanent? It seems that this question can be answered in the affirmative. The channel at the Patton break has been cut so deep that the water will continue to flow through to the desert at the lowest stages of the river. Hitherto, New River has always flowed when the Colorado marked 19 feet at Yuma. For months past the Colorado has poured down past Yuma 100,000 cubic feet per second to probably ten times that amount, the bulk of which has found its way to the Gulf, but a large portion has gone to the desert. According to the figures of conservative engineers, the inflow into the Salton basin the past 60 days has been not less than 8,548 cubic feet per second, exclusive of the evaporation and infiltration, which is very great for the distance of 200 miles.

If the sea becomes permanent, it may be a matter of only a short time till the Gulf is again connected with its old bed through New River. At all events the California peninsula will simply be extended northward

about two degrees of latitude, and with it would naturally come the finer climate of the peninsula. Southern California would then have summer rains, and its annual precipitation and irrigating supply would be increased.

The prevailing winds of Arizona are from the north and west over waterless wastes. The Colorado sea permanent, and the heights of the Mogollon and the Sierra Blanca would wring out of the moisture-laden winds a sufficient amount of rain to greatly increase the irrigating supply of that region. Perhaps it was when the Colorado River built its banks south to the Gulf, and dried up the desert sea, the Arizona mountain streams so decreased that the builders of the Casa Grande found it no longer profitable to war with nature and Apaches, and moved to the more favored vale of Anahuac.

LOS ANGELES, August 6, 1891.

Editor's Note.—It is of interest to reprint from the *New York Times* the remarks made by Maj. J. W. Powell, Director of the U. S. Geological Survey, to a reporter of that paper, in July :

The cause of the inundation, namely, the overflowing of the Colorado River through a newly-made mouth, had been correctly stated in the *Times*, he said, some time ago, and while this had cleared away all the sensational stories of a subterranean channel and stripped the phenomenon of all its mysterious elements, still there were many facts which were of interest in connection with the occurrence, because what had happened in this case might happen at the mouth of any river which had a delta.

"The traditions of the Indians are by no means the only evidence that this basin has been filled, wholly or partially, before," he said. "Since the delta was formed and that portion of the Gulf of California was cut off and left to evaporate under the terrific heat of the sun, the Colorado has been playing pranks of this sort on several occasions. Along the hills which form the sides of this basin there are shore-marks

which indicate that at different times the basin has been flooded to different heights, and then, when the river cut back through its old channel, evaporation has again changed the lake to a parched desert. Along these shore-lines shells have been found which confirm this theory. The action of the Colorado in cutting new mouths for itself and then stopping them up is comparatively rapid, because of the quantity of silt which the stream carries. It is not unlikely that the supposed traditions of the Indians are facts within the memory of some of the older ones of the scattering bands that live on the hillsides along the basin, for indications are that the valley has been inundated within fifty years, and certainly it has at least once or twice since this continent was discovered.

"There is no immediate danger of the basin being filled, because it requires a large volume of water to fill it to the river level, and the evaporation is something wonderful. At the present time, according to reports, only a fraction of the water in the Colorado is flowing from this new outlet. It is possible that the channel may be enlarged as the stream flows through it so that all the water in the river will pour into the basin. Even if that were to happen the evaporation is great enough to take up fully one-half of the Colorado as it spreads over the basin, and it would probably require from two to three years for the balance to fill the hole up to level. At times, when essentially the same thing has happened, a flood in the main body of the river has washed away the deposits at the mouth and the river has emptied itself from its natural mouth again, leaving the basin half filled. At such times as the river filled the basin to its level the flow to the Gulf of California has been through a channel which begins at the lower end of the basin and makes a short cut directly south to the salt water. This is called Hardy's Colorado, and it is usually simply a dry channel or ditch. It may have been formed under circumstances similar to those existing at present. It is large enough to accommodate the entire volume of the Colorado after the evaporation which is sure to take place while the water is spread over the basin.

"Some idea of the terrible heat may be had from the evaporation which takes place. If the basin were filled to the river level, the lake would present a surface of about 1,600 square miles. This would be lowered at the rate of six feet a year by evaporation. The salt which is now being mined at Salton was deposited by the previous evaporations. The original salt deposit from the water which was a part of the Gulf of California is not responsible for all that is found there. The waters of the Colorado are saline, for the river flows through beds of rock salt at places many miles up from its mouth, and the successive deposits from the waters of this river as they have flooded the valley and then dried up have added largely to the original deposit."